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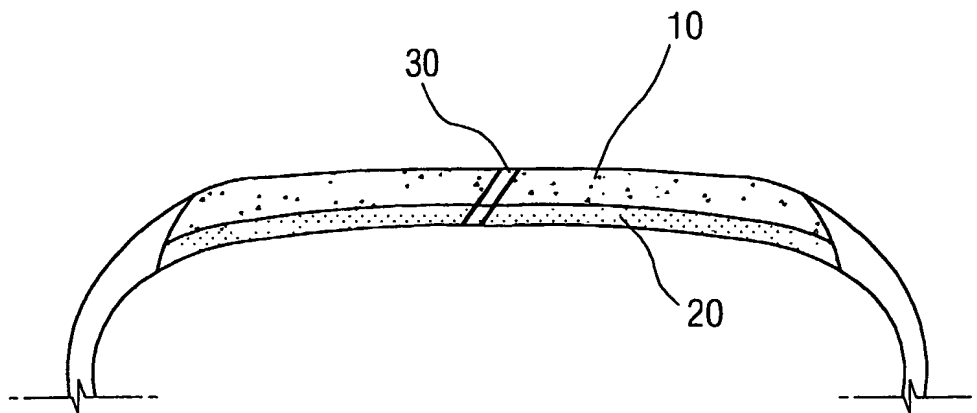
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: TIRE HAVING TREAD STRUCTURE FOR IMPROVING STATIC DISCHARGING PROPERTY



(57) Abstract: The present invention relates to a tire having a tread structure with improved electrostatic discharge properties, and more particularly, to a tire containing large amounts of silica, which has a tread structure with improved electrostatic electricity discharge properties. The tire of the present invention has a band-shaped electric discharge passage 30, which is extended from the under tread 20 to the outer surface of the cap tread 10 while being exposed to the outside of the tire through the outer surface of the cap tread 10. Thus, the tire of present invention has excellent conductivity without decreasing physical properties of the tread structure.

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TIRE HAVING TREAD STRUCTURE FOR IMPROVING STATIC DISCHARGING PROPERTY

Technical Field

5 The present invention relates to a tread structure of tires, and more particularly, to a tread structure, which easily discharges static electricity generated within a tire containing a great amount of silica.

Background Art

10 Recently, as the development of low fuel consumption tire is accelerated, the amount of silica used in preparing a tire is gradually increased and also the ratio of silica to carbon black is increased. Tire causes static electricity therein by friction with a road surface upon tire running. This generated static electricity is hardly discharged to the outside of cars, so that it gives a passenger unpleasant feelings by an electric shock when
15 he or she gets in or off a car. Furthermore, the static electricity generated by friction with the road surface generates electromagnetic waves while flowing through conductive portions of the cars, so that it adversely affects delicate portions of the cars, including a car engine, etc.

 Generally, in the case of a tread containing carbon black, it has a volume
20 resistivity of less than $10^8 \Omega\text{-cm}$, whereas in the case of a tread containing 100 % by weight of silica, it has an electric resistance of 10^9 to $10^{13} \Omega\text{-cm}$ or above and thus no a conductivity.

 In order to solve these electrostatic problems caused by the friction in the tire, a conductive cover strip is applied to the tire, or a certain amount of carbon black is
25 compounded with a rubber compound, so that the silica rubber compound as an insulator

is rendered conductive. However, in the case where carbon black is applied to the tire so as to ensure conductivity of the tire, there is a problem in that specific resistance of a tread is decreased, but a low fuel consumption property of the silica-containing tire is remarkably deteriorated. Furthermore, another problem is that the reinforcement of
5 polymer with the conductive carbon black is very low, so that abrasion resistance of the tire can be deteriorated.

Also, in the case of a method where water base cements mixed with the conductive carbon black is coated on the rubber surface of a tread cap layer, there is a disadvantage in that workability is decreased due to very low adhesion of the cement.
10 Furthermore, due to a problem associated with the storage of the cement itself, there is a disadvantage in that the coated cement may be detached or be a pollution source of a mold during vulcanization. In particular, during the vulcanization, adhesion at the interface between the rubber of the tread cap layer and the rubber coated on the water base cement is decreased, and hence, when tire running, detachment at the interface
15 occurs, and at the end of the tire running period, a conductive passage at the interface is broken, so that there is no antistatic effect.

In addition, there is another method where a conductive spray is applied to a tire. However, this method maintains electric discharge up to a certain level of abrasion of the tire, whereas it cannot provide the conductive passage, i.e., the electric discharge passage
20 after complete abrasion of the tire.

Disclosure of Invention

Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a tire where a tread structure is
25 modified without deteriorating abrasion resistance or low fuel consumption of the tire in

such a manner that the tread structure has a electric discharge passage, by which frictional static electricity generated within the tire is discharged to the outside of the tire.

To accomplish the above object, the present invention provides a tire having a tread structure comprising a cap tread forming the circumferential surface of the tire and an
5 under tread disposed on the inner surface of the cap tread, in which the tread structure includes a band-shaped electric discharge passage, which is extended from the under tread to the outer surface of the cap tread while being exposed to the outside of the tire through the outer surface of the cap tread.

The tire of present invention has an excellent conductivity without decreasing
10 physical properties of the tire tread.

Brief Description of the Drawings

Further objects and advantages of the invention will be more fully understood from the following detailed description taken in conjunction with the accompanying
15 drawings in which:

FIG. 1 is a partial cross-sectional view illustrating a tire having a tread structure with improved electrostatic discharge properties according to an embodiment of the present invention; and

FIG. 2 is a partial cross-sectional view illustrating a tire having a tread structure
20 with improved electrostatic discharge properties according to another embodiment of the present invention.

Best Mode for Carrying Out the Invention

A tread structure of a tire according to the present invention will now be
25 described in detail in connection with preferred embodiments with reference to the

accompanying drawings. For reference, like reference characters designate corresponding parts throughout several views.

FIG. 1 is a partial cross-sectional view illustrating a tire having a tread structure with improved electrostatic discharge properties according to an embodiment of the present invention

Referring to FIG. 1, the tread structure of a tire includes a cap tread 10 forming the circumferential surface of the tire, and an under tread 20. The under tread 20 is disposed below the cap tread 10 in such a manner that it is in contact with the inner surface of the cap tread 10 and connected to the inside of the tire.

As shown in FIG. 1, an electric discharge passage 30 is preferably made of the same material as the under tread 20. Also, the discharge passage 30 is formed in a band shape to be connected to the outer surface of the tread structure. Namely, the discharge passage 30 is extended from the inner surface of the under tread 20 to the outer surface of the cap tread 10 such that it is exposed to the outside of the tire and thus can be in contact with the ground.

A rubber composition for forming the cap tread 10 preferably contains silica at the amount of more than 50 PHR (part per hundred rubber) or at the amount of 70% by weight relative to the total weight of fillers. The rubber composition, which is an insulator having an electric resistance of 10^9 to $10^{13} \Omega\text{-cm}$ or above, cannot discharge any static electricity generated in a car body to the ground. The rubber composition for forming the cap tread 10 is not limited to the rubber composition containing silica. For example, solution-polymerized styrene-butadiene rubber, emulsion-polymerized styrene-butadiene rubber, butadiene rubber or natural rubber alone, or a mixture thereof may be used in the rubber composition, to which a great amount of silica as a filler is compounded. Other known compounding materials used in conventional rubber

compounds, including vulcanizing agents, vulcanization accelerators, vulcanization accelerating assistants, softening agents, antioxidants, etc., may also be used in the rubber composition.

Meanwhile, a rubber composition for forming the under tread 20 preferably
5 contains And, a great amount to 100% by weight of carbon black (C/B), and the discharge passage 30 is also preferably formed of the same rubber composition as the under tread 20. The rubber composition for forming the discharge passage 30 has an electric resistance of less than $10^8 \Omega\text{-cm}$, so that it can easily discharge frictional static electricity generated at the inside of the tread.

10 In other words, in the tire having the tread structure with an improved static-discharging property according to the present invention, the rubber composition of the outermost cap tread 10 forming the circumferential surface of the tire has a high silica content to make rotational resistance and brake force of the tire excellent. At the same time, the rubber composition of the under tread 20 has a high carbon black content such
15 that frictional static electricity generated within the cap tread 10 of the tire is collected in the under tread 20 and then discharged through the discharge passage 30 to the outside of the tire.

High electric resistance according to the high silica content of the cap tread 10 is
overcame by the under tread 20, so that static electricity is easily discharged to the
20 outside of the tire through the discharge passage 30 while the tire with an advantage of low fuel consumption is obtained. An angle of the discharge passage 30 extended from the under tread 20 to the outer surface of the cap tread 20 is preferably 90° to 180° .

FIG. 2 is a partial cross-sectional view illustrating a tire having a tread structure with improved electrostatic discharge properties according to another embodiment of the
25 present invention.

Unlike the embodiment of FIG. 1, in the tire shown in FIG. 2, more than one discharge passage 30 is formed, so that frictional static electricity collected in the under tread 20 can be more efficiently discharged to the ground. Also, the discharge passage 30 can be formed in a center or both sides of the tread according to a groove shape of a tread pattern, and serially disposed along a running direction of the tire. In the case of disposing the discharge passage 30 at both sides of the tread, the under tread 20 is preferably made from a rubber compound having excellent ozone resistance because the under tread 20 generally has relatively inferior physical properties and poor ozone resistance as compared with the cap tread 10.

10

Industrial Applicability

As described above, the tire having the tread structure with improved electrostatic discharge properties according to the present invention has an advantage in that the tire can easily discharge frictional electricity generated in the tread structure to the outside of the tire, without decreasing physical properties of the tread structure, such as abrasion resistance, rotational resistance and brake force, in order to increase conductivity of the tread structure.

15

Furthermore, the tire of the present invention has a reduced cost of production, since the under tread 20 and the discharge passage 30 is made of the rubber compound containing inexpensive carbon black instead of expensive silica.

20

While the present invention has been described with reference to the particular illustrative embodiments, it is not to be restricted by the embodiments but only by the appended claims. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present invention.

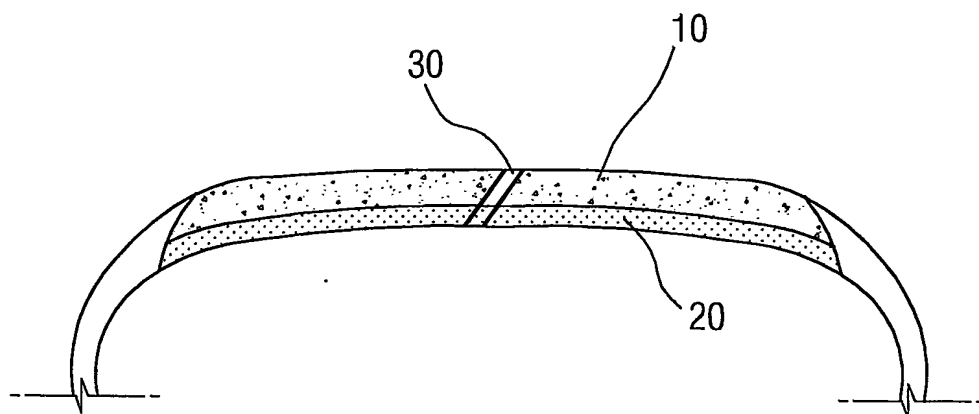
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What Is Claimed Is:

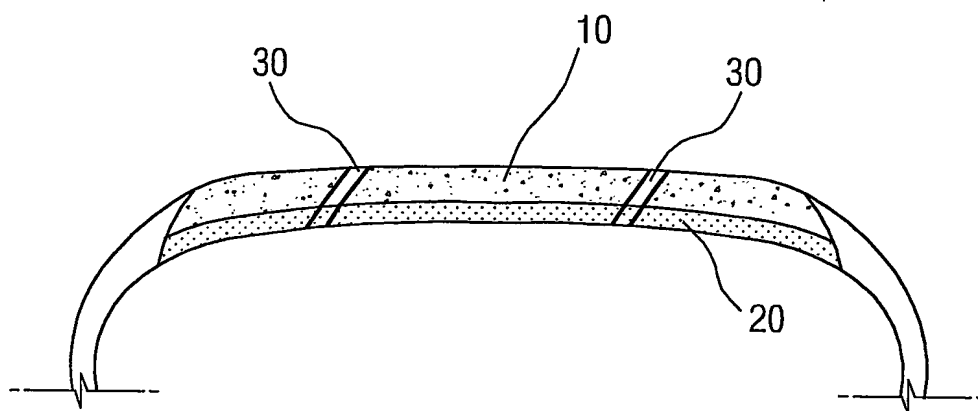
1. A tire having a tread structure comprising a cap tread 10 forming the circumferential surface of the tire and an under tread 20 disposed on the inner surface of the cap tread, in which the tread structure includes a band-shaped electric discharge passage 30, which is extended from the under tread 20 to the outer surface of the cap tread 10 while being exposed to the outside of the tire through the outer surface of the cap tread 10.
2. The tire according to claim 1, wherein said cap tread 10 is formed of a rubber composition containing silica at the amount of more than 50 PHR or at the amount of more than 70 % by weight relative to the total weight of fillers.
3. The tire according to claim 1, wherein each of the under tread 20 and the discharge passage 30 is formed of a rubber composition containing carbon black at the amount of up to 100 % by weight.
4. The tire according to claim 1, wherein an angle of said discharge passage 30 extended from the under tread 20 to the outer surface of the cap tread is 90° to 180°.
5. The tire according to claim 1, which comprises at least two of the discharge passages 30.

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【FIG. 1】



【FIG. 2】



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR03/00110

A. CLASSIFICATION OF SUBJECT MATTER**IPC7 B60C 11/00**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B60C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

KR, JP : IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 2001-41285 A(CALVAR, Didier; NICOLAS, Serge; BARDY, Daniel) 15 May 2001 See all document; Figures 1a, 1b	1, 2, 4
X	KR 2001-41330 A(CALVAR, Didier; NICOLAS, Serge; BARDY, Daniel) 15 May 2001 See all document; Figures 1a, 1b	1, 2, 4
Y	KR 2000-20301 A(PARK, Jong-Hyun)15 April 2000 See the Abstract; Claims 1-3; Figures 1-3	1-4
Y	KR 2000-20302 A(MOON, Dal-Yong; BAEG, Han-seung; UM, Jin-Sup)15 April 2000 See the Abstract; Claims 1-3; Figures 1-5	1-4

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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